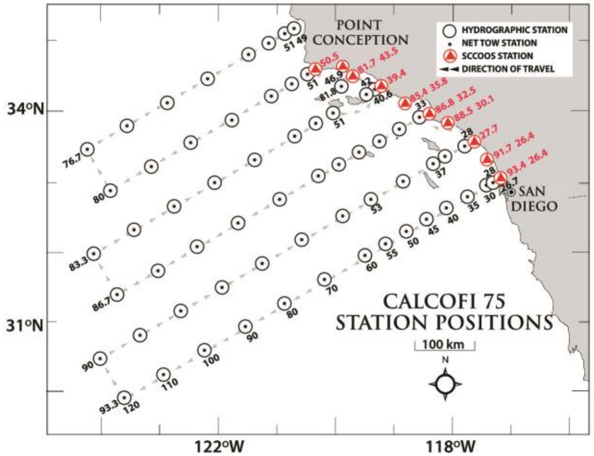
NOAA FISHERIES
SWFSC

7.4 CalCOFI and Spring Sardine Surveys

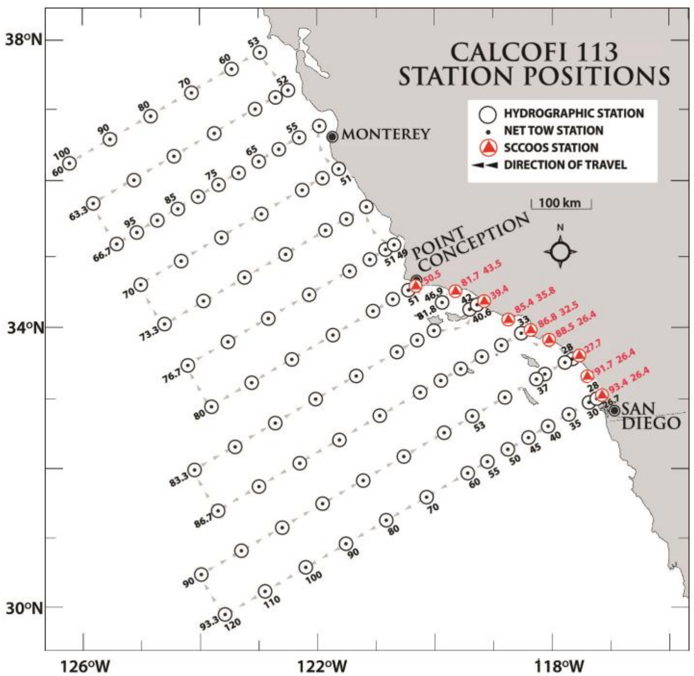
Sam McClatchie

- Overview of life-history data collected on CalCOFI and Spring Sardine surveys.
- How are the data managed?
- Issues with data management.

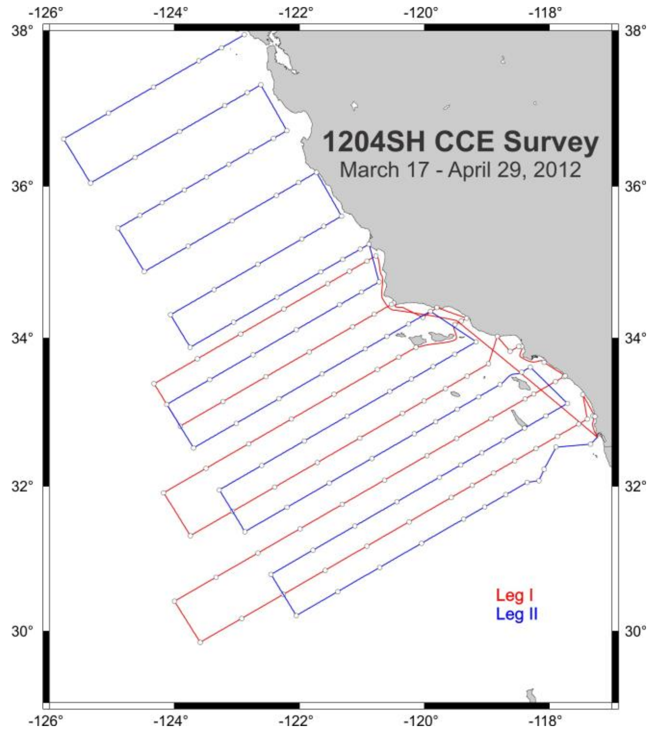
Quarterly CalCOFI survey

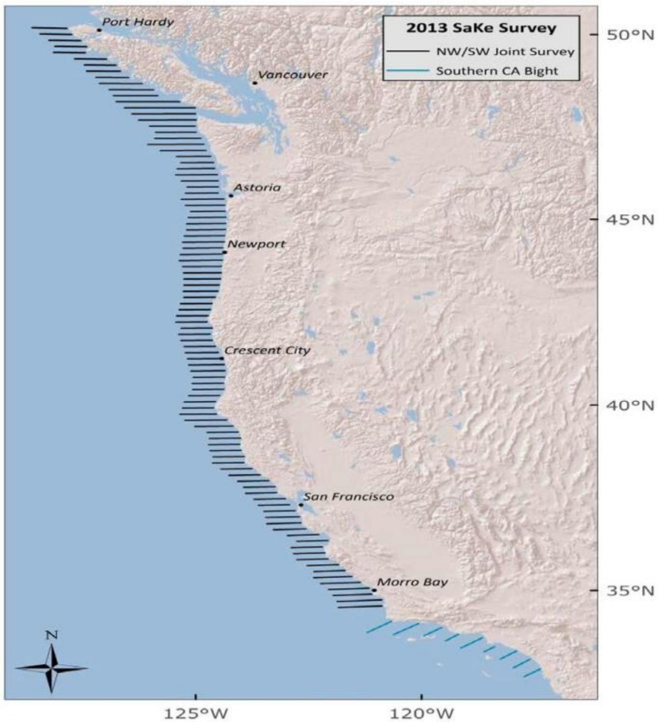


Spring CalCOFI survey

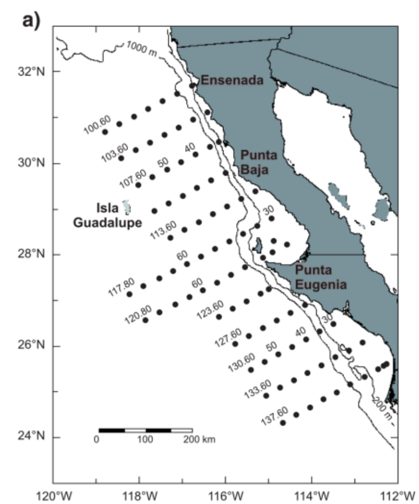


Spring sardine survey

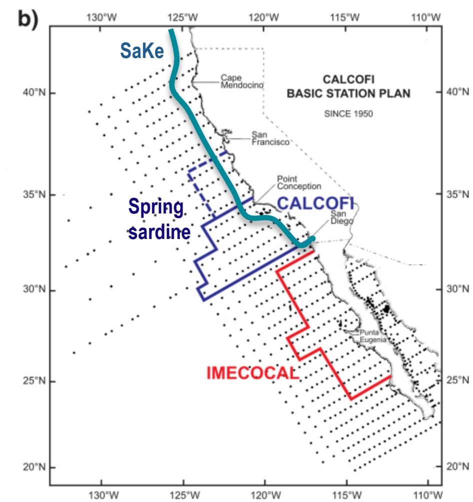




Summer SaKe survey



Quarterly IMECOCAL survey



Compare survey domains

Surveys

Goals

Spring Sardine Survey goals are focused on assessment

- Estimate the spawning stock biomass of Pacific sardine using the Daily Egg Production Method (DEPM).
- Estimate the total biomass of Pacific sardine using the acoustic/ trawl method.
- Estimate the confidence limits on the biomass estimates.
- Map the spatial distribution of Coastal Pelagic Species adults (and juveniles where possible).
- Map the spatial distribution of early life history stages (eggs and larvae) of Coastal Pelagic Species and the broader ichthyoplankton community.

CalCOFI goals are much broader than assessment goals

- CalCOFI is focused on understanding the long-term changes in the California Current System (physical, biological & chemical).
- This goal is recognized as being intimately linked with basin-scale processes, and CalCOFI has been embedded in larger scale studies of the Pacific since its early days.
- The current focus of the CalCOFI program is now enabled by numerous other programs that piggy-back on and supplement the core survey program.
- CalCOFI provides the second longest marine time series in the world (currently 63 years).

Surveys

Spring Sardine Survey. Categories of data

(data directly relevant to assessment are highlighted in red)

- Hydrographic
- Ichthyoplankton and zooplankton
- Reproductive, age and growth of Coastal Pelagic Species (CPS)
- Relative abundance and sizes of CPS
- Acoustic backscatter

9 science staff

Spring Sardine Survey. Sampling by category

(data directly relevant to assessment are highlighted in red)

Hydrographic	**CTD Sensors:**	**Bottle Samples:**
	Temperature	
	Conductivity	none
	Oxygen	
Ichthyoplankton & Zooplankton	**Nets & CUFES:**	
	Bongo net, 210m - all stations	
	Manta neuston net, all stations	
	Pairovet vertical net to 70 m (or 5 m off bottom)	
	Continuous Underway Fish Egg Sampler (CUFES)	
Acoustics & Trawling (for target ID & reproduction, growth)	Acoustics (5 frequencies)	
	Nordic trawl (back tracking to fish on acoustic fish marks)	

CalCOFI: Categories of data

(data directly relevant to assessment are highlighted in red)

- Hydrographic
- Ichthyoplankton and zooplankton
- Primary productivity, fractionations, POC/DOC, DIC
- Acoustics
- Mammal & seabirds

18 science staff (note that no trawling is done, which would require at least 3 more staff)

CalCOFI: Sampling by category

Hydrographic

CTD Sensors:
Temperature
Conductivity
Oxygen
Fluorescence
Transmissomter
PAR
pH

Bottle Samples:
Salinity
Oxygen
Nutrients
Primary Productivity
Chlorophyll-a
Phaeopigments
HPLC
DIC
LTER ancillary

Ichthyoplankton & Zooplankton

Nets & CUFES:
Bongo net, 210m - all stations
Manta neuston net, all stations
PRPOOS vertical net, lines 80 & 90, 86.7 & 83.3 coastal only
Pairovet vertical net, 100m (coastal stations only to 70 m)
Continuous Underway Fish Egg Sampler (CUFES)

Primary productivity, fractionations, POC/DOC, DIC, Acoustics, Birds and Mammals

Supplementary Data:
SCS, Underway continuous surface and meteorological measurements
Primary Productivity, Daily C14-uptake incubations
Ancillary LTER , Plankton abundance, biomass, Chl a size fractionations, POC, DOC
Acoustics (5 freqencies)
DIC, 10 stations: 93.3-30, 90-90, 90-60, 90-53, 90-30, 86.7-35, 81.8-46.9, 80-55, 80-80, 80-90
Seabirds , Visual Observations
Cetaceans, Visual and Passive acoustic surveys


Surveys
Data management

How data are managed

- Data processing has developed on an "as needed" basis over many years.
- It is fair to say that there was a lack of coherent vision guiding the process.
- Documentation of data processing scripts was done retroactively and very late.
- Until the last 5 years, many datasets were held on individual scientists computers with no consistent data management or backup systems.
- Full integration of data into databases is still not complete (e.g. for the hydrographic data, or the trawl data from Spring sardine cruises).
- Data process improvement has been limited by hiring restrictions.
- Progress on serving data has leap-frogged improvement on processing the data.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APRIL 2012

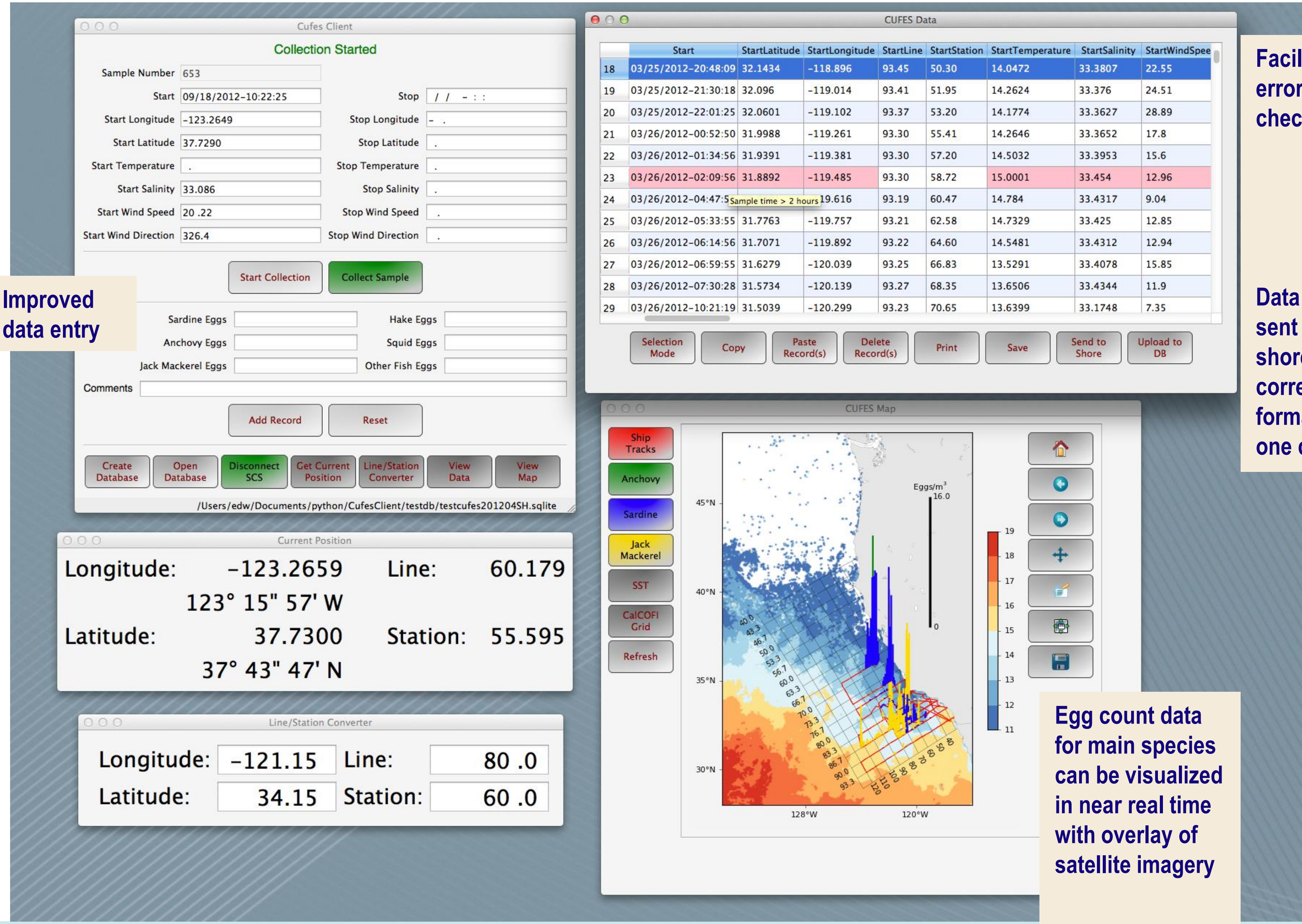
MANUAL OF PROCEDURES FOR
CalCOFI AND ANCILLARY DATA

by

Susan Jacobson, Amy Hays, Beverly Macewicz,
Susan Manion, David Griffith, Ed Weber, and Sam McClatchie

ADMINISTRATIVE REPORT LJ-12-03

Sea-going data logging, data entry, and data checking systems also need improvement. We are tackling these on a case by case basis. One example is the new CUFES interface shown here:



Improved data entry

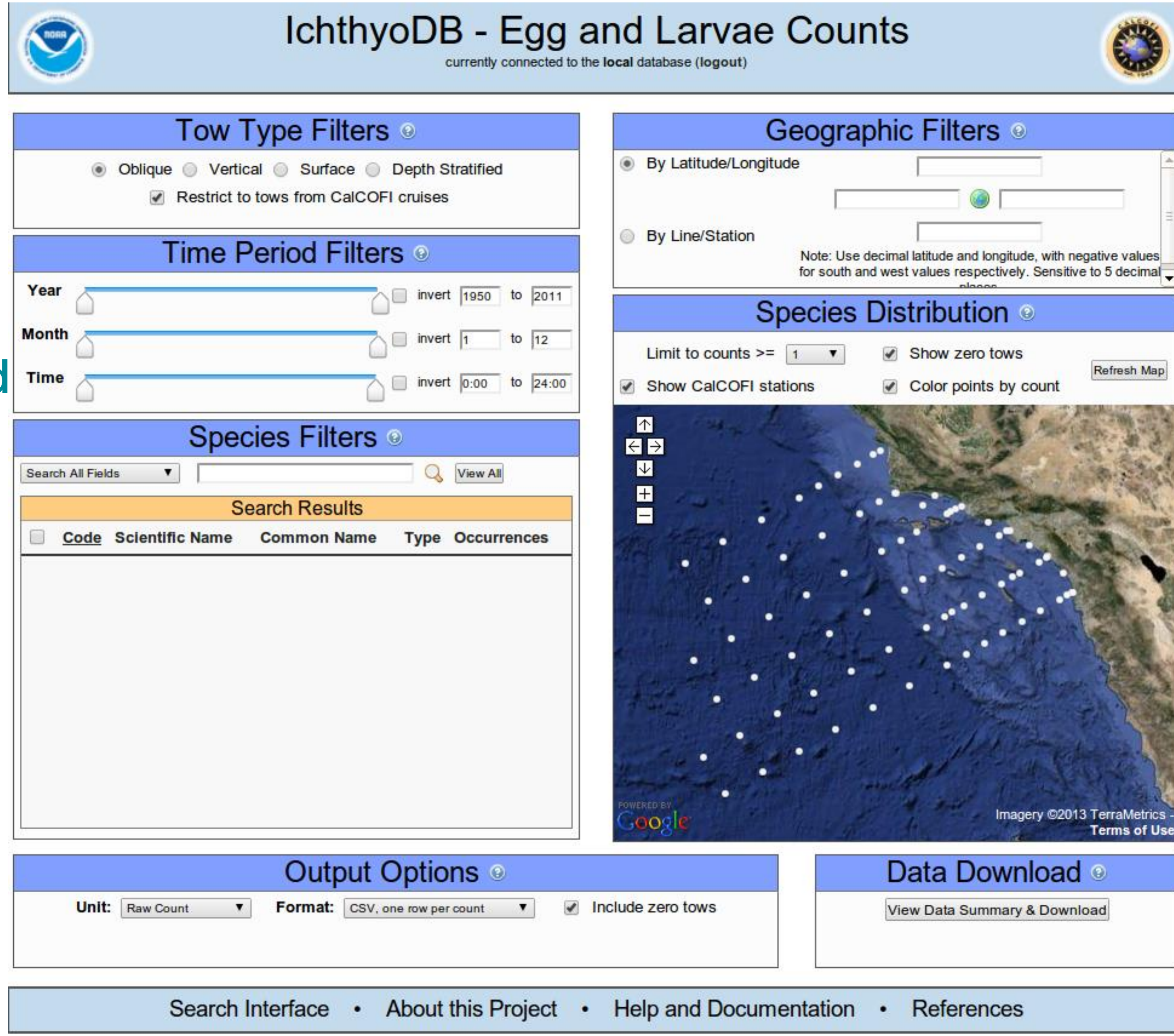
Facilitates error checking

Data can be sent to shore in correct format with one click

Egg count data for main species can be visualized in near real time with overlay of satellite imagery

Data serving:

IchthyoDB provides a user-friendly GUI for data selection and download of the entire ichthyoplankton database (all species). Metadata are provided on the web pages.



Data serving:

IchthyoDB will soon be discontinued in favor of a more sophisticated interface.

IchthyoDB - Egg and Larvae Counts

Note: Numbers and densities of eggs captured provide indices of abundance that are unique to each tow type. So, for example, number of eggs captured in an oblique tow should never be compared with number of eggs captured in a vertical tow. Several other important changes have occurred in sampling methods for collecting icthyoplankton. In 1969, tow depths extended from 140 m to 210 m, and nets were changed from 0.55-mm-mesh silk to 0.505-mm-mesh nylon. In 1977, oblique tows were changed from using 1-m bridled ring nets (denoted C1 in the data) to 0.71-m bridleless bongo nets (denoted CB). See Hewitt 1980, Brinton and Townsend 1981, and Ohman and Smith 1995 (References, below) for details.

Summary

Unit:	Count
ShortTowType:	C1,CB
CruiseTypeCode:	C
Line:	77-93
Station:	35-100
Year:	2011-2011
Month:	3-5
TowBegin:	0:00-24:00

Codes

Type	Code	Definition
Cruise	C	CALCOFI
Tow	CB	CalCOFI Oblique Bongo Tow
ErrorCode	0-19	**SWFSC Tow Quality**

Taxonomies

CalCOFI #	ITIS #	Scientific Name	Common Name	Type
9555	82406	Abralia		Larvae
9556	556021	Abralia trigonura		Larvae
9560	82398	Abraliopsis Identified: 2008-present Notes: Some taxa identifed to various levels in some samples prior to 2008		Larvae
9559	82402	Abraliopsis affinis		Larvae
9561	82401	Abraliopsis felis Identified: 2008-present Notes: Some taxa identifed to various levels in some samples prior to 2008		Larvae
9562	82398	Abraliopsis sp A		Larvae
9563	82398	Abraliopsis sp B Identified: 2008-present Notes: Some taxa identifed to various levels in some samples prior to 2008		Larvae
623	170045	Abudefduf	Sergeant majors	Larvae
621	615041	Abudefduf declivifrons	Mexican nightsergeant	Larvae
622	170054	Abudefduf troschelii	Panamic sergeant major	Larvae
576	172451	Acanthocybium solandri	Wahoo	Larvae
585	172250	Acanthuridae	Surgeonfishes	Larvae
2190	172251	Acanthurus		Larvae

References

Brinton, E., and A. W. Townsend. 1981. A comparison of euphausiid abundances from bongo and 1-M CalCOFI nets. Calif. Coop. Oceanic Fish. Invest. Rep. 22:111-125. (**PDF**)

Hewitt, R.P. 1980. Distributional atlas of fish larvae in the California Current region: northern anchovy, Engraulis mordax Girard, 1966 through 1979. Calif. Coop. Oceanic Fish. Invest. Atlas 28:I-101 (**PDF**)

Kramer, D., M.J. Kalin, E.G. Stevens, J.R. Thrailkill and J.R. Zweifel, 1972. Collecting and processing data on fish eggs and larvae in the California Current region. NOAA Technical Report NMFS CIRC-370. (**PDF**)

Ohman, M. D. and P. E. Smith. 1995. A comparison of zooplankton sampling methods in the CalCOFI time series. CalCOFI Rep. 36:153-158. (**PDF**)

Smith, P.E. and S.L. Richardson, 1977. Standard techniques for pelagic fish egg and larva surveys. FAO Fisheries Technical Paper, (175):100 p. Issued also in Spanish (**PDF**)

NOAA Southwest Fisheries Science Center - Gear Descriptions

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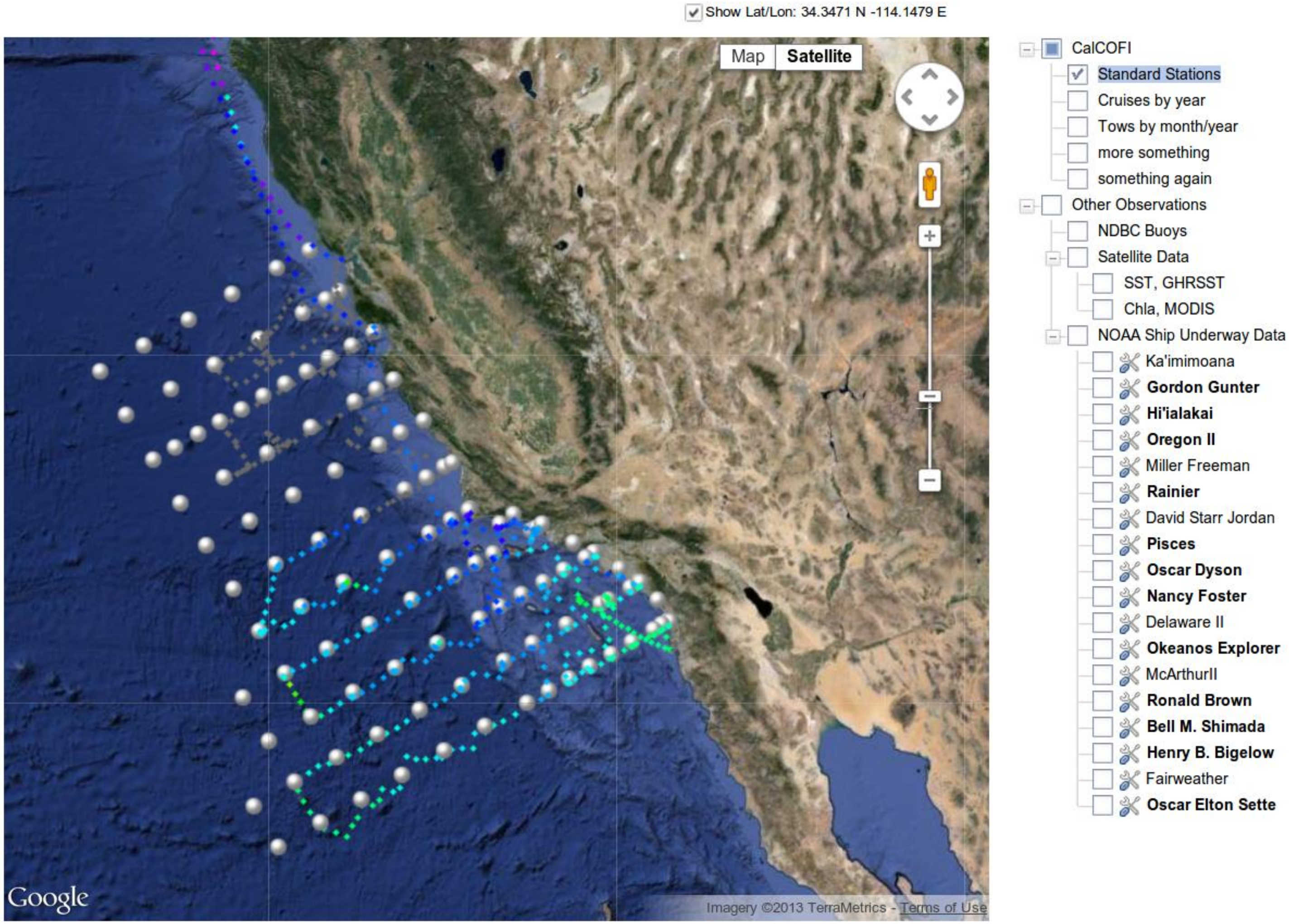
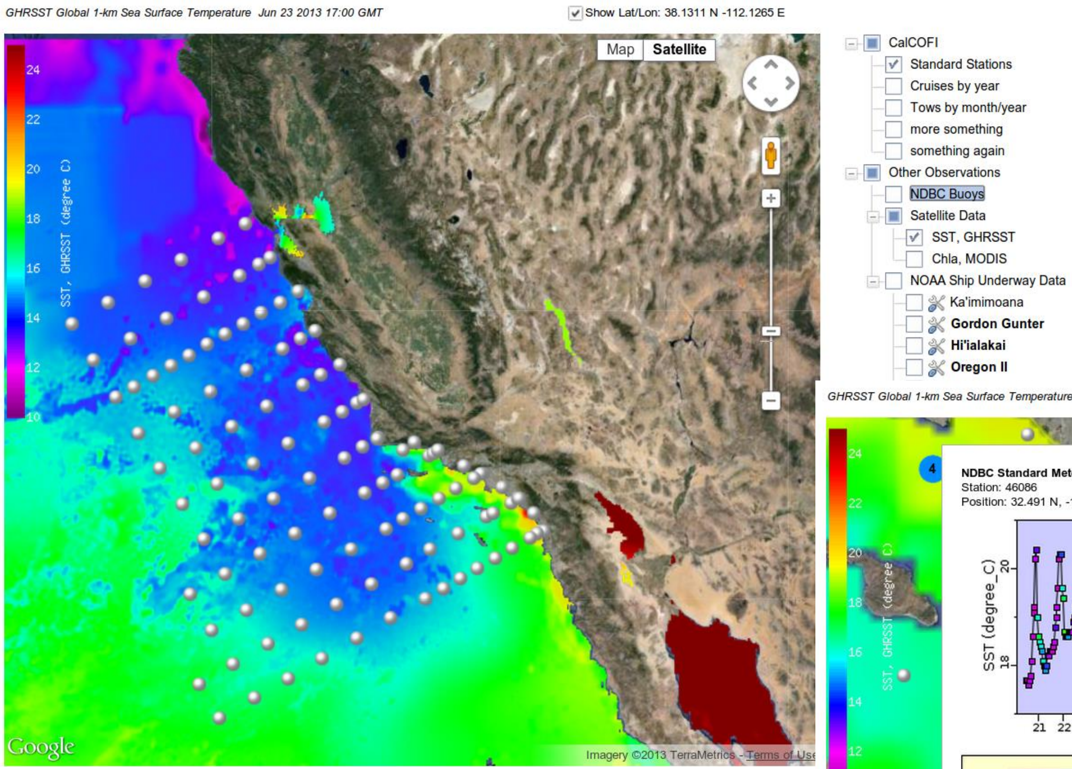
Download Data File

Data serving: The new system is being developed through ERDDAP

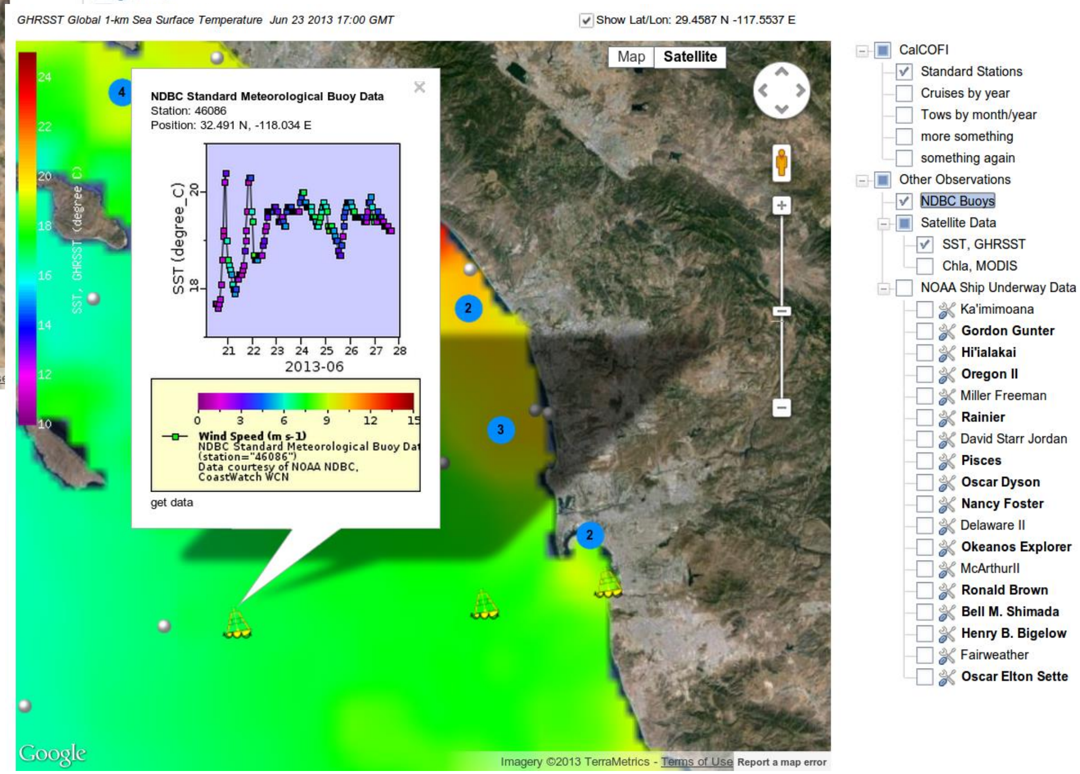


Spring 2013 CalCOFI and spring sardine survey colored by temperature from vessel SES

Data serving: ERDDAP



Overlays of remotely sensed SST and ocean color

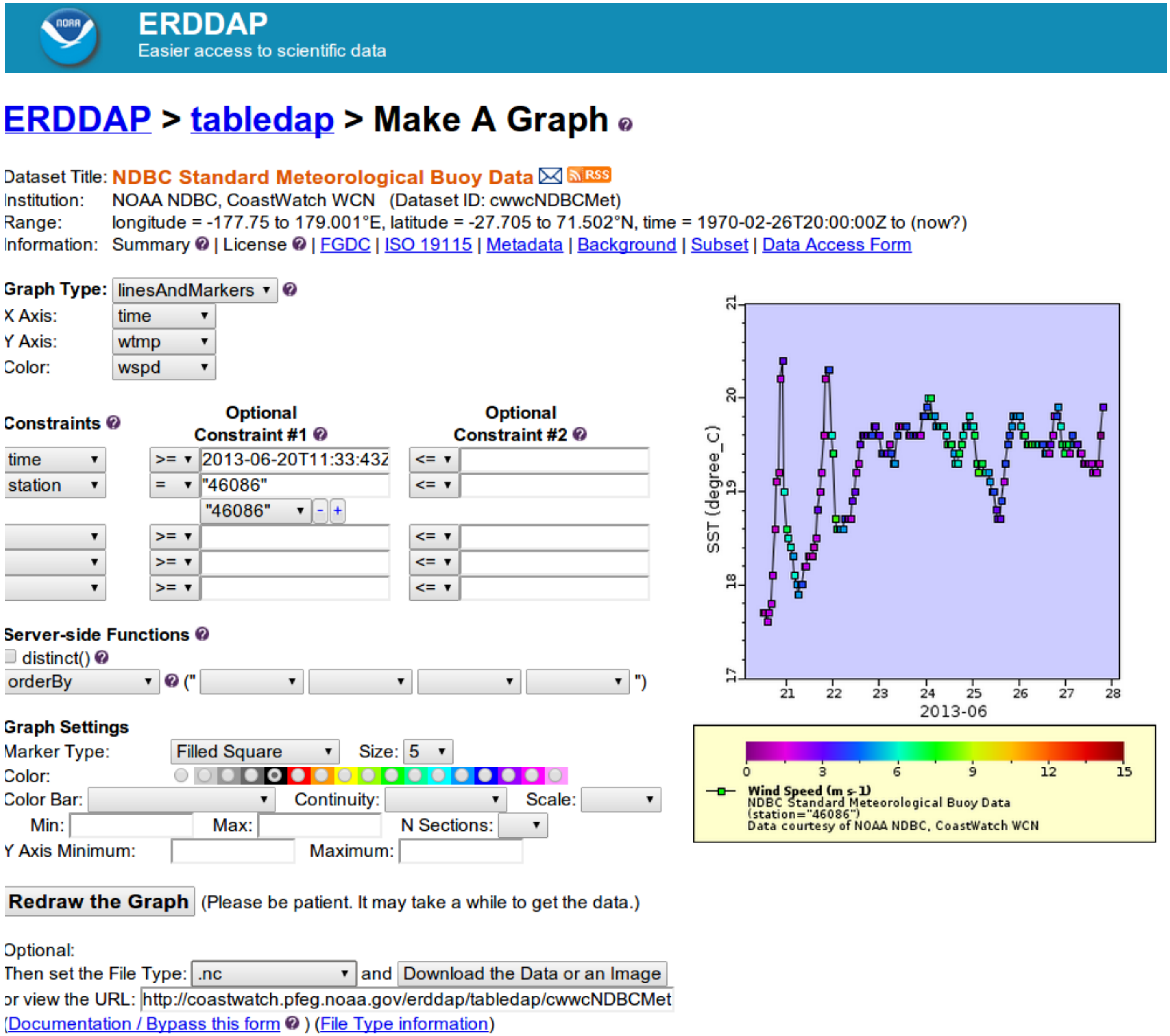


Ancillary data from buoys

Directly linked to ERDDAP data serving GUI

Data are queriable from within analysis programs (like R, Matlab, NCL) using Opendap protocol to access data on remote servers.

Coming soon: Full access to all 63 years of CalCOFI ichthyoplankton and hydrographic data.



Summary

1. Strengths

- Methods are well established, refined and validated. The process of improvement was documented in peer-reviewed publications.
- Continuity of long time series where changes have been well tested against established methods before change is adopted.
- Efficient teams with many years of experience with the surveys.

2. Main challenges

- How to modernize and improve the existing data systems in the face of retirements without replacements.
- Restructuring the databases (e.g. to move from fixed-format to date-time and spatial data classes).
- How to meet the increasingly heavy demands of surveys for staff and financial resources.
- How to best incorporate new technologies to increase spatial and temporal sampling resolution.
- How to balance the demands of stock assessment with the need for data informing broader climate and ecosystem issues.

Summary continued

3. Strategies for improvements (i.e., to address the challenges)

- Piecemeal data processing procedures need to be modernized, integrated and streamlined.
- Legacy software and scripts need to be replaced while maintaining continuity.
- The old processing systems need to be run in parallel with a new system prior to replacement with a new system.
- A programmer should be hired on a term position with the explicit goal of designing and implementing a new data system.
- The task should be carefully focused to deal with critical issues first, to overcome bottlenecks, reduce risks, and to make sure that goals are achieved.
- Efficient but parallel data streams for hydrographic, ichthyoplankton, trawl, and acoustic data will likely be necessary, up to the point where the data are served through a system like ERDDAP.